

hypothesis testing. The presentation stresses the fact that, unlike frequentist inferences, Bayesian inferences, being based on the posterior distribution, are conditional on the actual sample that was observed. Chapters 10 and 11 cover Bayesian inference for a normal mean under flat, conjugate, and nonconjugate priors and presents a comparison with frequentist techniques, following the basic outline of Chapters 8 and 9. Two-sample problems for normal means and binomial proportions are presented in Chapters 12. Chapter 13 covers simple linear regression using Bayesian methods. Chapter 14 discusses how to guard against prior misspecification by performing robust Bayesian inferences with mixtures of conjugate priors.

I really like the fact that, as Bayesian methods are developed, they are compared with frequentist methods. This gives readers with prior exposure to the frequentist approach a level of familiarity to work from and an opportunity to appreciate the differences between the two perspectives. This book would be a good choice as a textbook for an introductory undergraduate course on Bayesian methods aimed at students majoring or minoring in statistics. The book could also be used as a reference in a survey course where students sample from many different topics to spark their interest.

A good knowledge of calculus (differentiation and integration) is needed to understand and practice the ideas presented in the book. A 20-page calculus appendix provides a review of the needed prerequisite topics. At least one prior course in statistics is also a must, in my opinion, to fully appreciate the comparisons between Bayesian and frequentist methods. The reader would want to be able to focus on the Bayesian developments here (and the coverage can at times get quite in-depth) without having to learn everything about statistics all at once. There are exercises at the end of each chapter, focusing primarily on Bayesian methods. The computer-based exercises can be solved using Minitab or R macros that can be downloaded from the Web. Some of the macros can be used to perform Monte Carlo simulations to study the frequentist performance of Bayesian methods. The exercises are somewhat sparse, but they are challenging and thoughtfully written. They should be especially useful for group work and in-class discussions.

If you find yourself (or your students) caught up in the "Bayesian versus frequentist" debate and want to find out more about the Bayesian side of things, the preface of this book provides a very lively and interesting discussion of (if not an argument for) the Bayesian perspective.

I would recommend this book if you are interested in teaching an introductory course in Bayesian statistics to students who have a strong calculus background and a solid foundation in (the traditional form of) introductory statistics.

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The Challenge of Developing Statistical Literacy, Reasoning and Thinking.

Dani BEN-ZVI and Joan GARFIELD (eds.). Dordrecht: Kluwer Academic Publishers, 2004, xiii + 423 pp., \$171.00 (H), ISBN: 1-4020-2277-8; Ebook ISBN: 1-4020-2278-6.

As those of us who have taught statistics know, many students struggle to grasp key ideas and concepts and are unable to successfully apply them in practice. The combination of mathematical demands and the lack of intuition causes learning to be difficult and painful. This book strives to discuss some of these issues. This collection contains 17 chapters written by many of the leaders in this area and gives wonderful insights into why effective teaching of statistical content is increasingly important, reasons why students struggle, how learning takes place, and practical ideas about how to tackle challenging topics.

The book is organized into three major sections: an introduction to statistical literacy, reasoning, and thinking; studies of statistical reasoning; and instructional, curricular, and research issues. The first section clarifies what is meant by statistical literacy, reasoning, and thinking, since these terms have previously been used differently in various discussions. Once a solid framework has been established for what instructors of introductory statistics courses should require their students to master, the book proceeds to discuss a number of the traditionally most challenging topics, including data analysis, variability, covariance, sampling, sampling distributions, and the normal distribution. The final section gives targeted strategies for different levels of education, from primary through university level instruction.

As David Moore, a pioneer in innovative instruction of statistical thinking, notes in the Foreword, the need for this book is particularly strong at this moment for three reasons. First, teachers of statistics as a group have much to learn about

the study of learning from the experts in this area. Second, data-oriented statistics is becoming an increasingly mainstream topic for students at all academics levels and in an increasing number of disciplines. Finally, the recognition of statistics as a discipline that is related but distinct from mathematics leads to some profound insights into how statistics should be instructed differently from traditional mathematics.

This book will be a valuable reference for all teachers of statistics who struggle to convey the difficult and challenging nature of our discipline to beginners. As the media and more professions make greater use of data, statistical thinking, reasoning, and literacy are becoming increasingly important concepts for daily life. I enjoyed reading this book both for not only the careful documentation of why we should be approaching student learning in particular ways, but also for the many insights on how to communicate the essence of our discipline.

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Innovations in Teaching Statistics.

Joan B. GARFIELD (ed.). Washington, DC: Mathematical Association of America, 2005, ix + 141 pp., \$47.50 (P), ISBN: 0-88385-175-X.

Achieving Quantitative Literacy: An Urgent Challenge for Higher Education.

Lynn STEEN. Washington, DC: Mathematical Association of America, 2004, xvi + 115 pp., \$27.95 (P), ISBN: 0-88385-816-9.

It is certainly true that most professional statisticians do not devote their professional lives to teaching the first and second undergraduate courses in statistics. Around the world, however, thousands of these first and second courses are taught every semester and thus it follows that most of them are being taught by people who have received their graduate education in a field outside of statistics. At my own institution, for example, the teaching of the first statistics course is done largely by faculty from the economics department. Many of the economists are skilled quantitative researchers, and their familiarity with statistics is often substantial, yet for most of them it remains at most a secondary interest. Increasing numbers of our students are placing out of the first course thanks to successful completion of the Advanced Placement course while in high school. The chance that a high school teacher holds an advanced degree in statistics is quite slight indeed. Is there any other area of study that has a higher proportion of students introduced to the subject by somebody whose primary academic training is in another field?

The argument above raises an important question for American Statistical Association (ASA) members. If nonspecialists are to teach the beginning courses in our subject, who (if anyone) will advise on how to teach it? The Mathematical Association of America (MAA) is an organization that has historically taken a very proactive role in the education of mathematics teachers at all levels. Recognizing that mathematics faculty from universities, colleges, and high schools are being pressed into service teaching statistics, the MAA has become increasingly interested in providing useful teaching resources for mathematicians teaching statistics. In addition to a service role in statistics, some math teachers have been asked to lead in the more broadly defined area of ensuring the "quantitative literacy" of their students, another area for which an undergraduate mathematics education degree might not be the ideal preparation.

In an often-discussed article from 1988, David Moore asked the question "Should mathematicians teach statistics?" He claimed the answer was "No!", but that article and the discussion published with it were among the factors that helped start a surge of activity from the MAA to help change that answer. Throughout the 1990s and the first half of the current decade, the MAA has organized regional workshops on teaching statistics, held mini-courses on the topic at national meetings, and published a number of teaching aids for mathematicians teaching statistics or quantitative literacy courses. The two books under review here can be seen as among the more recent attempts to help ensure that mathematicians teaching outside of their traditional areas will have the resources they need to do a good job.

The collection of essays in *Innovations in Teaching Statistics* would be excellent light reading for even the most experienced teachers in the ASA. The book is divided into sections by the type of students that are being addressed, and in easy article leaders in the field of statistics education provide some concrete examples of techniques they use to make their own courses better. I know almost all of the authors and have heard most of them present at a variety of

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